



Managing Effects of Climate Change At NASA's Wallops Flight Facility

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2010 INTERNATIONAL WORKSHOP ON ENVIRONMENT AND ENERGY

"Global Collaboration in Sustainable Environmental and Alternative Energy Strategies"

San Diego, California | November 2 - 4, 2010



Wallops Island, Virginia - East Coast, USA



**NASA/GSFC
Greenbelt**

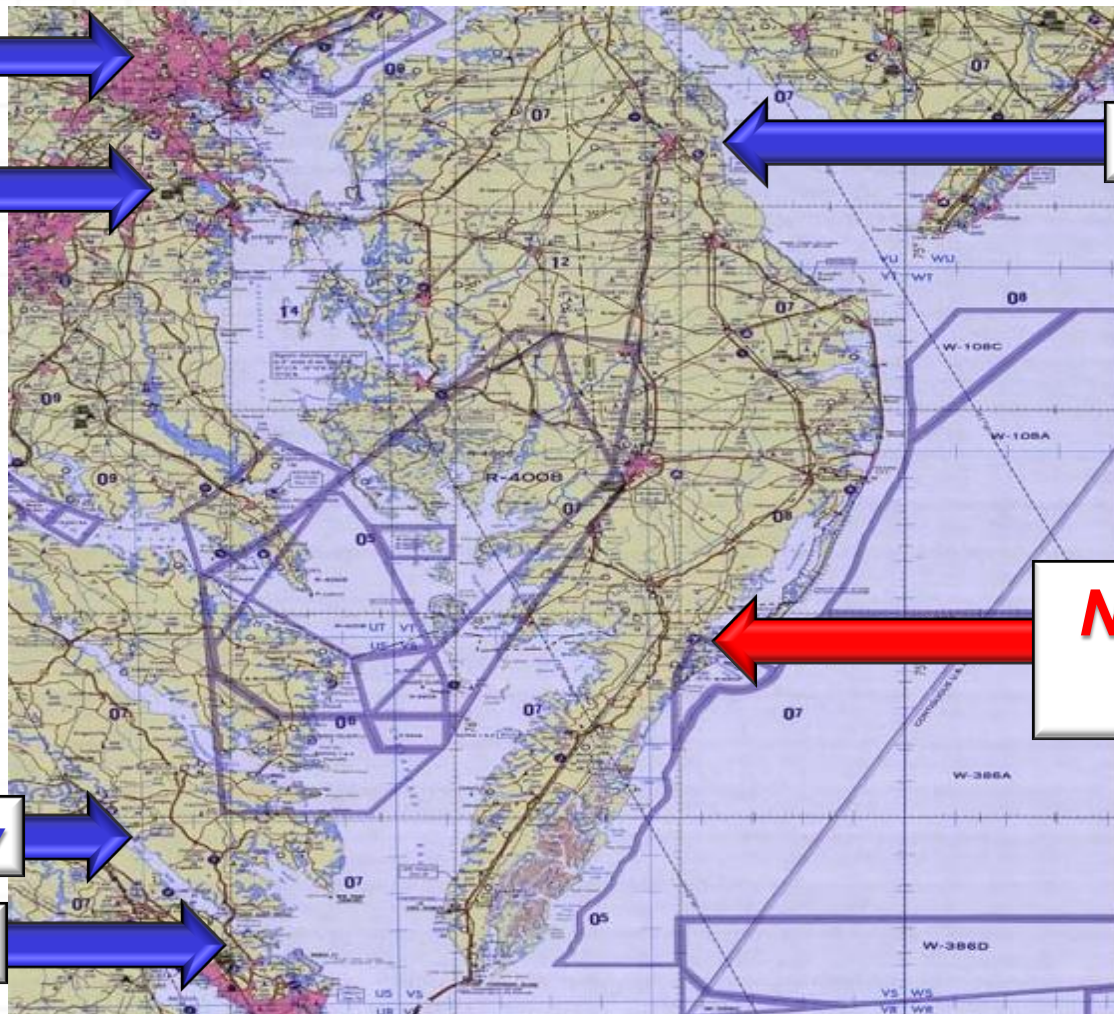
D.C. Area

Dover AFB

**NASA/GSFC
WFF**

NASA/Langley

Norfolk Area

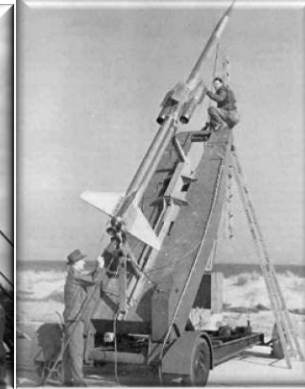




Wallops Island History



- Established by National Advisory Committee on Aeronautics in 1945 as test site for aerodynamic research
- Over 16,000 launches conducted from Wallops Island during 65 year history
- Wallops mission has evolved to include:
 - Flight program management
 - Technology development
 - Scientific research
 - Orbital Launches





Wallops 6000 Acre Facility

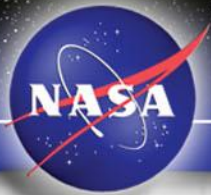


Main Base



Wallops Island





Wallops Mission and Activities



Mission

Wallops Facility will be a national resource for enabling low-cost aerospace-based science and technology

Technical Activities

- Research Carriers
 - Sounding Rockets
 - Balloons
 - Aircraft & UAVs
 - Small Orbital Carriers
- Engineering Development & Technology Validation
 - Supporting Goddard Spacecraft Instruments and Subsystems
- Earth Science Research
- Mission Operations
 - Launch Range
 - Research Airport
 - Orbital Tracking

Wallops Island

Wallops Island

Wallops Island

Wallops Island



U.S. Navy at Wallops



- Surface Combat Systems Center
 - Aegis Combat Training Center
 - Cruiser & destroyer simulators
 - Crew training
 - System development test bed
 - Ship Self-Defense Facility
 - DDG(1000) Engineering Facility
- Naval Air Warfare Center (Patuxent River)
 - Target launch operations
 - Aircraft development testing



Mid-Atlantic Regional Spaceport (MARS)



Minotaur I



Launch Pad 0-B





COTS and CRS Missions



- Taurus II Rocket launches
- NASA's Commercial Orbital Transportation Services (COTS)
- NASA's Commercial Resupply Services (CRS)
- \$40M state and federal investment





Why is WFF a National Asset?



Wallops Island – NASA's only owned Launch Range

- Other launch facilities are owned and operated by DOD and are subject to their scheduling and mission priorities
- NASA is a Civilian Agency with scientific mission
- GSFC, WFF's lead Center, is the world leader in climate change research
- WFF's Mission is low-cost, rapid access to space



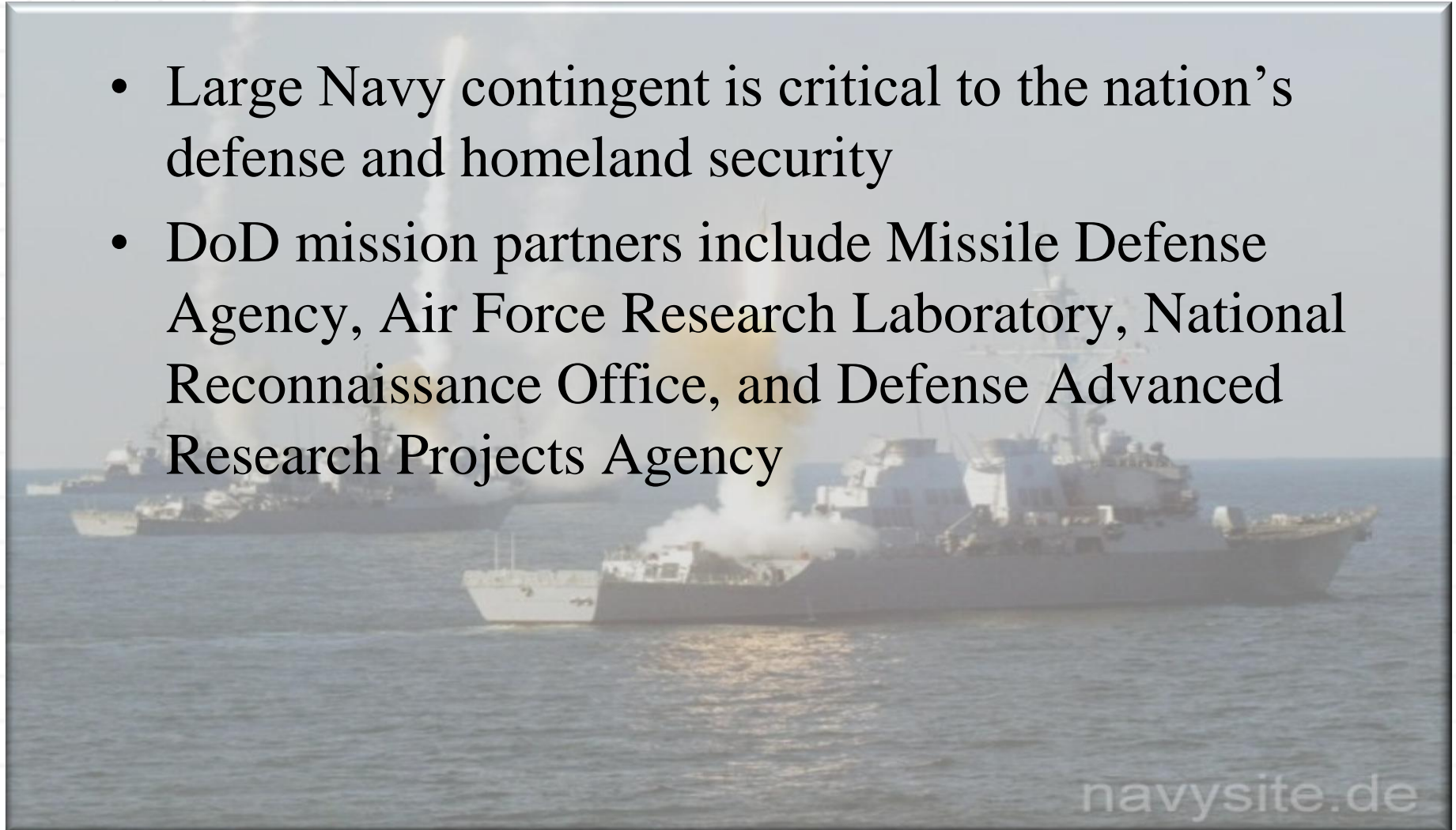


Why is WFF a National Asset?



Wallops Island – National Defense

- Large Navy contingent is critical to the nation's defense and homeland security
- DoD mission partners include Missile Defense Agency, Air Force Research Laboratory, National Reconnaissance Office, and Defense Advanced Research Projects Agency





WFF as an Economic Engine



Benefits

- In 2008, WFF (NASA, Tenants, & Contractors) employed 1,485 people
- NASA activities generated \$250 Million in local revenue:
 - \$133 Million from Wallops Research Park
 - \$90 Million from Sounding Rocket launches
 - \$6-24 Million from ELV (orbital class) launches
 - \$1 Million from UAS



\$1.2 Billion in Total Assets



Current Value of Wallops Island Assets

NASA: \$170 Million

Navy: \$70 Million

**Plus \$800 Million
outfitting**

MARS: \$5 Million

Total: \$1.1 Billion

**Supporting: \$46.5 Million
in NASA and \$50 Million
in Navy Programs
Annually**

New Launch Range Infrastructure Investment

Virginia: \$26 Million

Federal: \$14 Million

Private Sector: \$15 Million

**Total: \$55 Million for
\$1.9 Billion Program
(Taurus II CRS)**

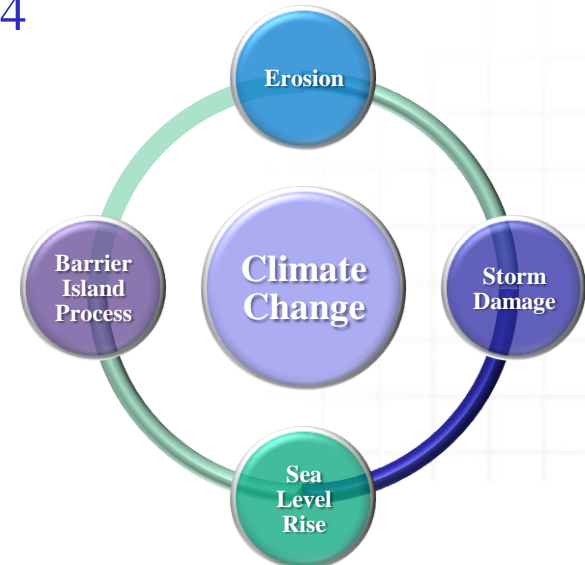


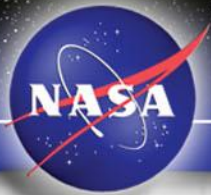


The Challenge



- NASA established presence in the 1940s
- 150 years of “chronic erosion”
- Atlantic Ocean encroaching toward launch pads and infrastructure
- Southern part of Wallops Island retreated approx. 450 M (1350 feet) between 1857 and 1994



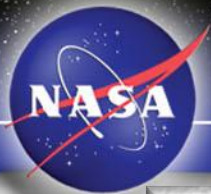


History of Mitigation Efforts

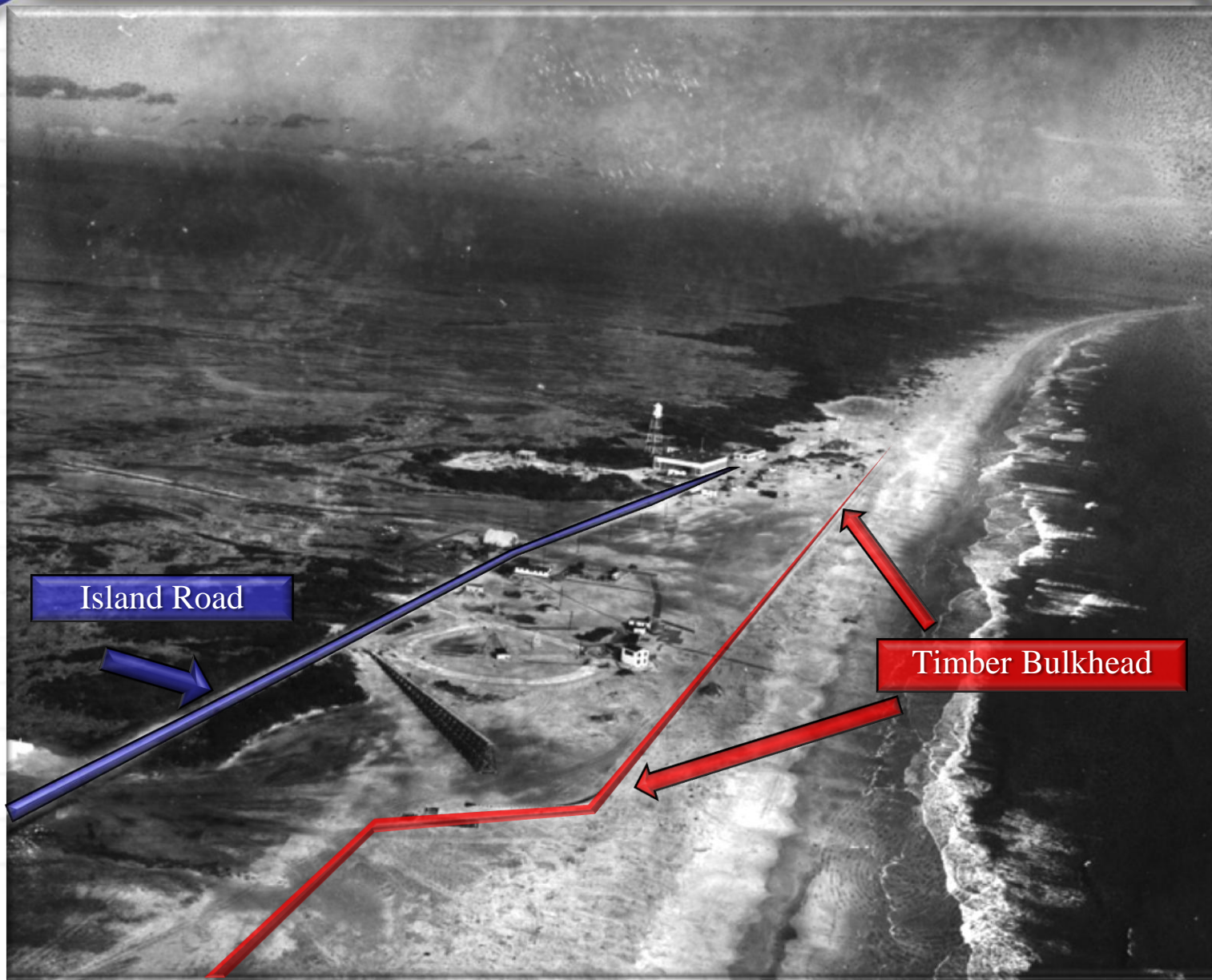


- 1940's** Timber bulkhead
- 1950's** 8 wood groins and bulkheads, concrete aprons, and rock rubble mounds
- 1960's** Groins and seawall extended north
- 1970's** 47 wood groins and seawall modifications (e.g., extended, augmented, and repaired several times)
- 1980's** Experimental designs (e.g., beach prism/beam sand retention units) and seawall modifications
- 1990's** Rock seawall and "failed groins" of the 70's removed
- 2000's** Seawall modifications and geotextile tubes

NACA
LMAL
44585



1946

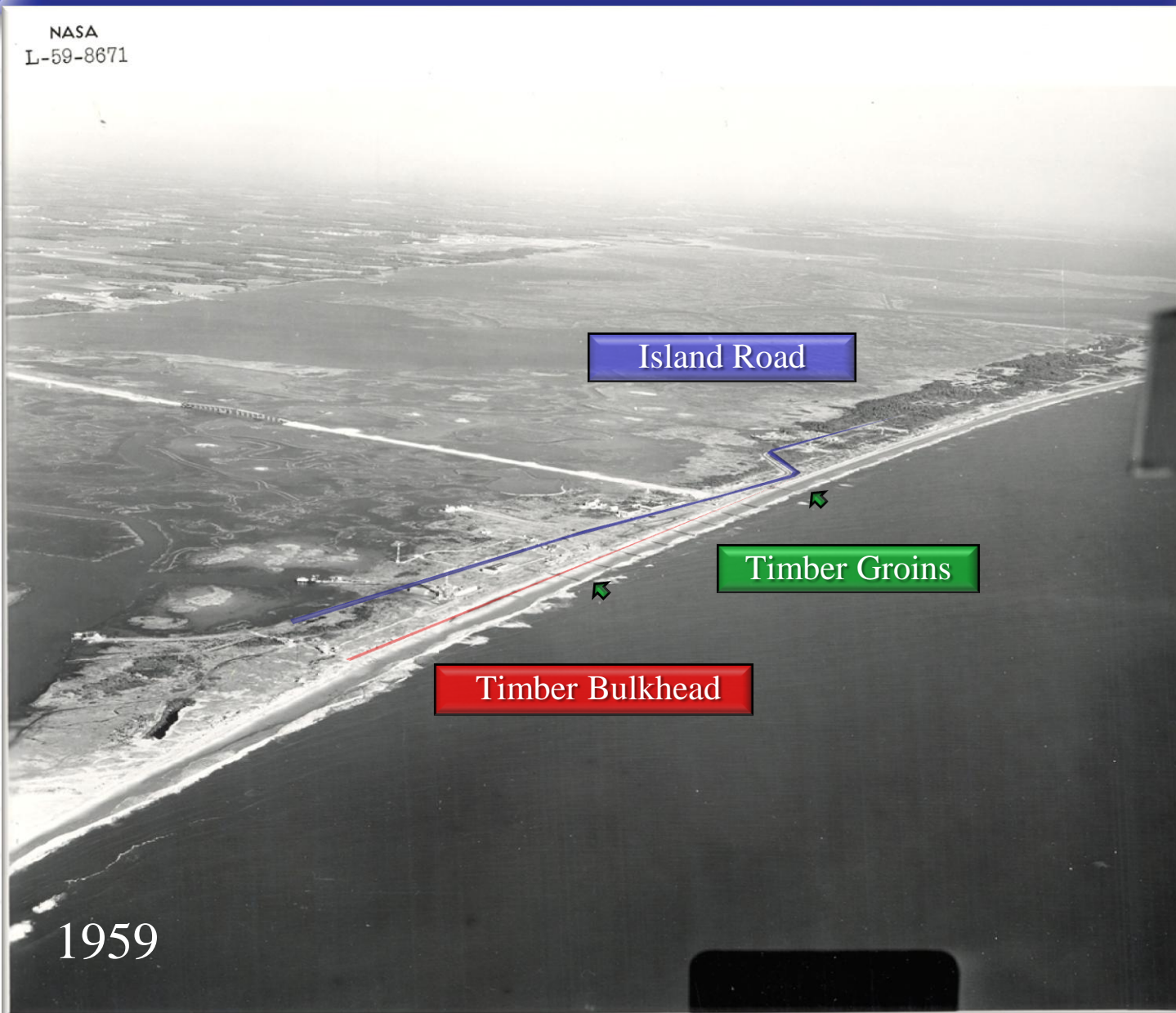


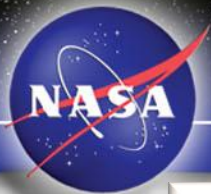


1959 – South End



NASA
L-59-8671

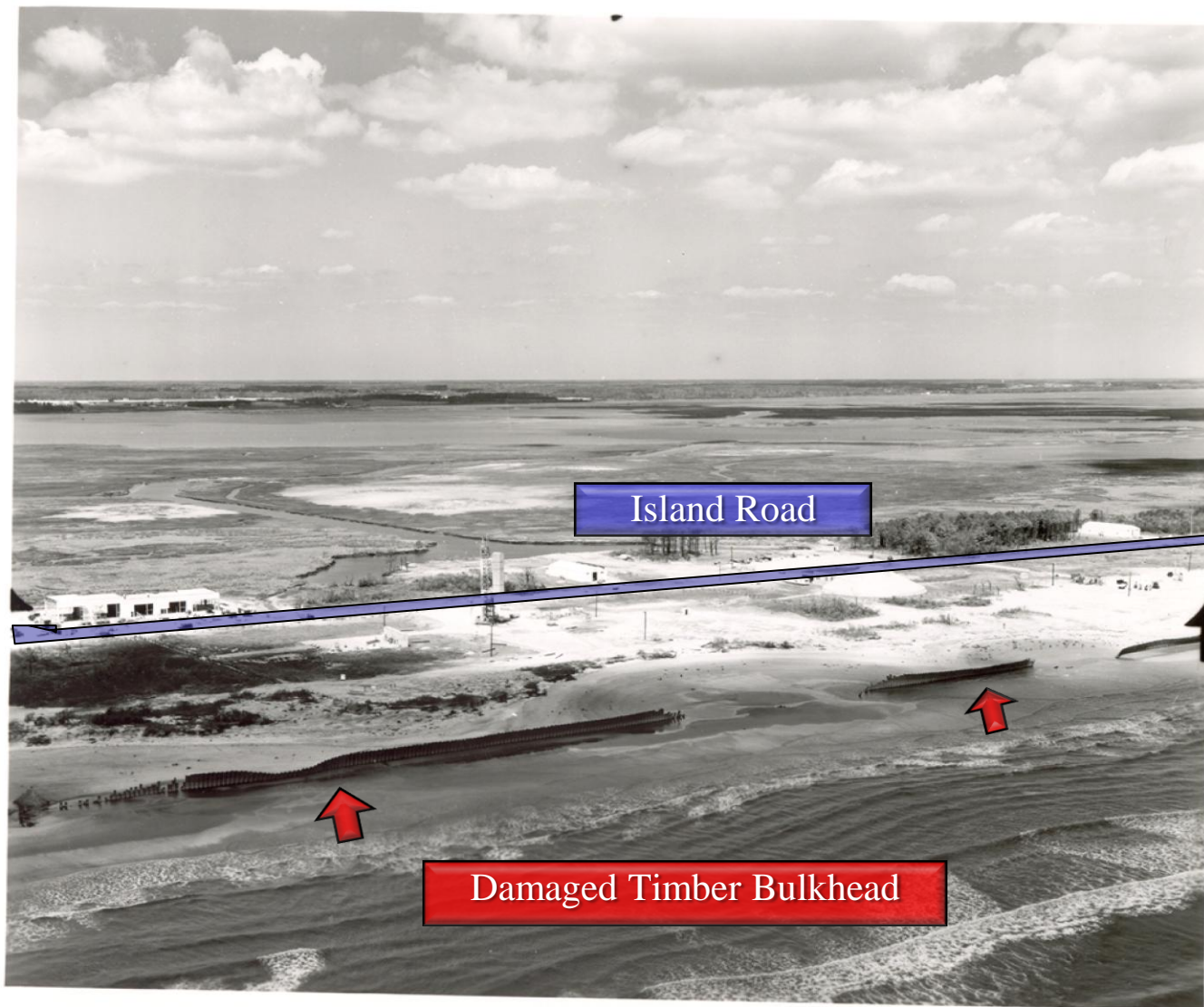




1962



NASA
L-62-2793





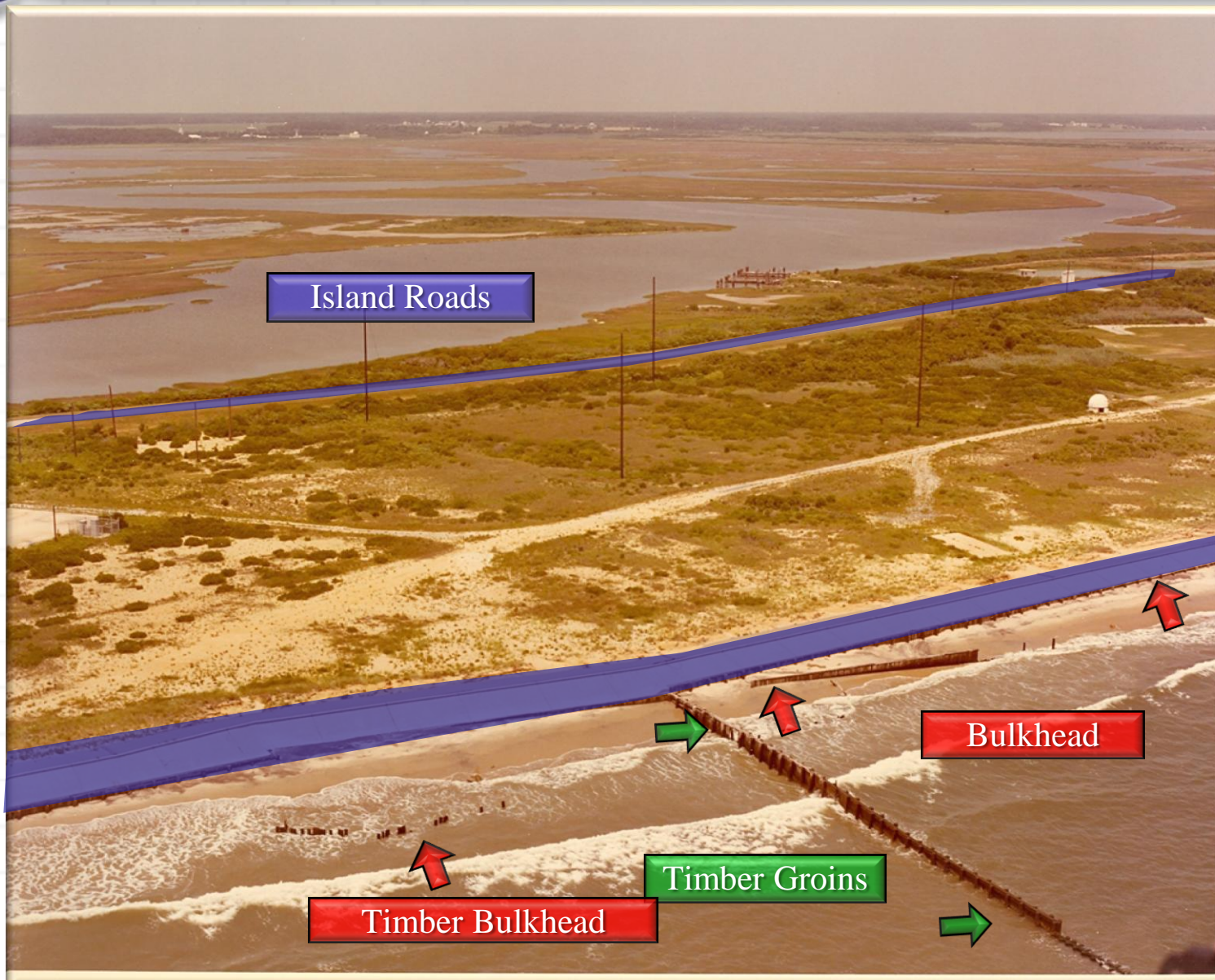
1976

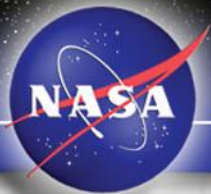


1976

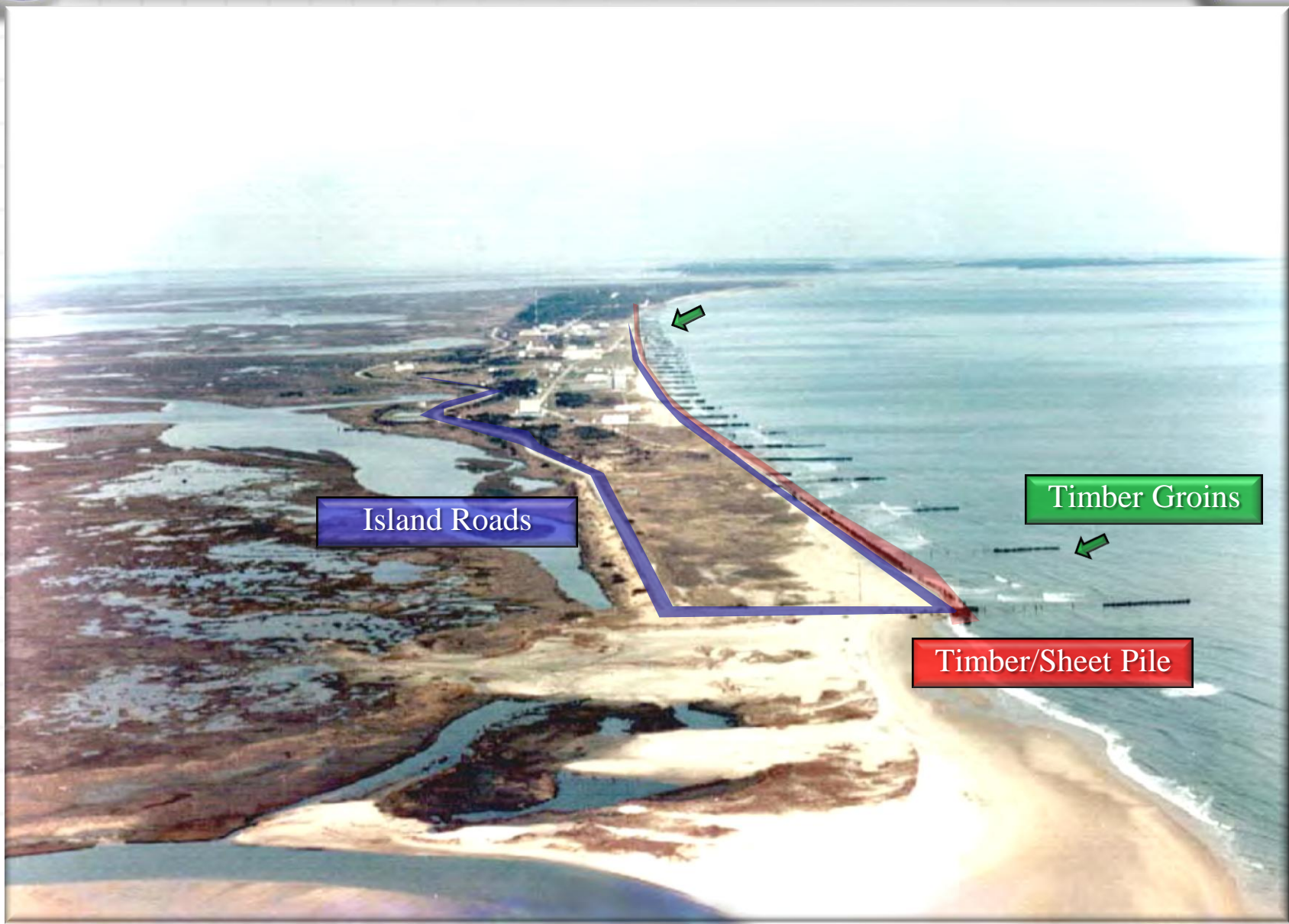


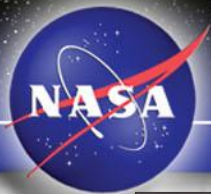
1981





1983





1987





1988 - Experimental “Beach Berms”



Timber Groins

Concrete Prisms

Sheet Pile

Island Road

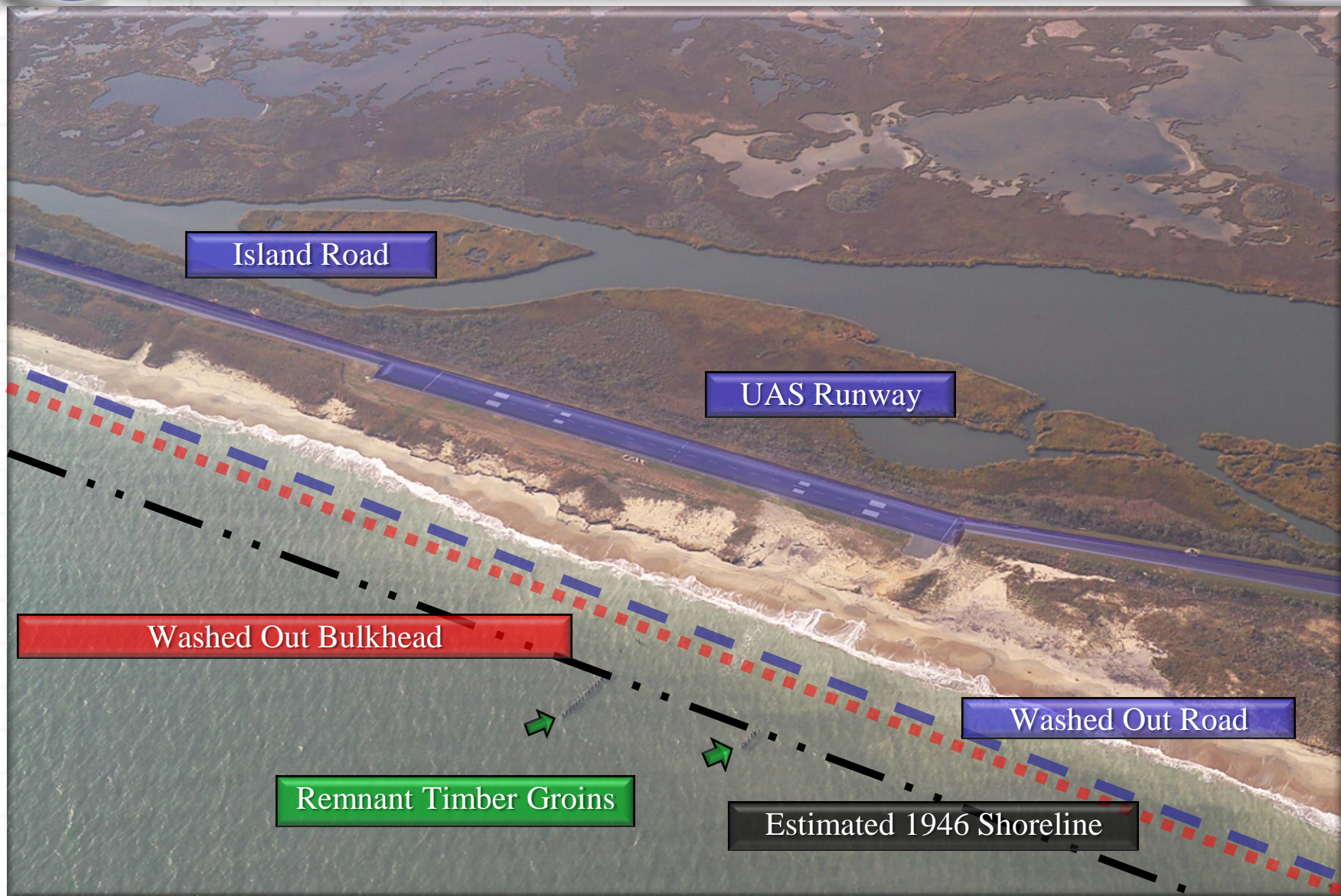


Mid 1990's to Present - Seawall





2005





What's at Risk?

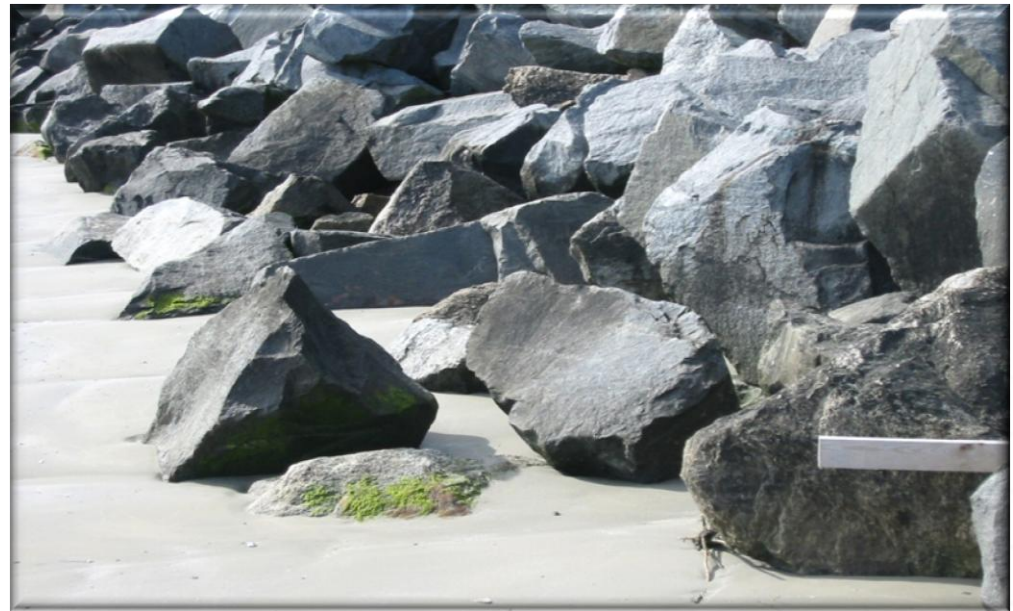


\$1.2 Billion in State and Federal Assets



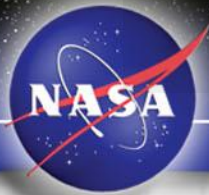
MARS Pad 0-B

- Located directly adjacent to the Atlantic Ocean



Seawall

- Never intended to be the primary wearing surface between the Atlantic Ocean and the Launch Range



Mitigation - Today and into the Future



Shoreline Restoration and Infrastructure Protection Program

- NASA retained U.S. Army Corps of Engineers (USACE) for design and construction
- 50 year planning horizon
- Goal: reduce damage to Federal and State Infrastructure
- National Environmental Policy Act (NEPA)
 - Programmatic Environmental Impact Statement (EIS)
 - Bureau of Ocean Energy Management, Regulation, and Enforcement and USACE as Cooperating Agencies
 - Final PEIS under Public Review



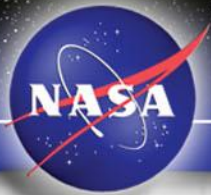


Physical Processes



- **Beach Erosion**
 - Chronic
 - Day in and day out
 - Long term retreat
 - Continuous wearing
 - Permanent loss of beach
 - Allows increased storm damage
 - Further undermining of seawall
- **Storm Damage**
 - Acute
 - Short term
 - Big changes
 - Elevated water levels
 - Large waves
 - Flooding
 - Infrastructure destruction

**THESE PROCESSES ARE ACCELERATED BY SEA LEVEL RISE
AND INTENSIFIED STORM AND WAVE EVENTS ATTRIBUTED TO
CLIMATE CHANGE.**

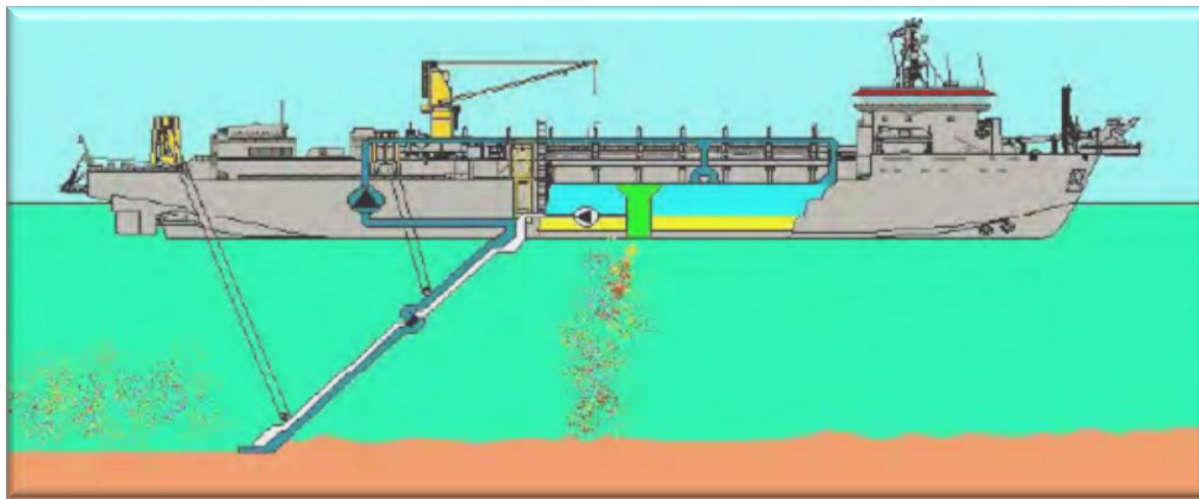


SRIPP – The Details



- Initial Work

- Rehabilitate existing seawall as needed (Current)
- Build seawall extension (400 meters [~1350 ft])
(March 2011 –Nov 2011)
- 2,450,000 m³ (3,200,000 yds³) sand over 6.8
kilometers (4.25 miles) provides 30 meters (100 feet)
of dry beach in front of seawall (Jan 2012 – Jan 2013)





SRIPP – The Details



- Beach Fill Renourishment every 5-7 years over 50 Years
 - 616,000 m³ (800,000 yds³) sand
- Long Term Monitoring, Analysis, and Mitigation
- Over \$40M+ Project



(c) Rich Galiano



Historical Storm Analysis



- 149 Year Storm Dataset
 - Hurricanes – 41 between 1854 and 2003
 - Nor'easters – 39 between 1954 and 2003
- Basis for Design Development
- 2006 Hurricanes “Ernesto” and “Florence” created a loss of asphalt along existing UAV Runway



Before 2009 Nor'easter Damage - South End





After 2009 Nor'easter Damage – South End





Calculation of Sea-Level Rise



**Total eustatic sea level rise –
 0.17 ± 0.05 m /100 yr.**

*The future rate of eustatic
sea level rise is projected to
significantly exceed the
historical rate.*

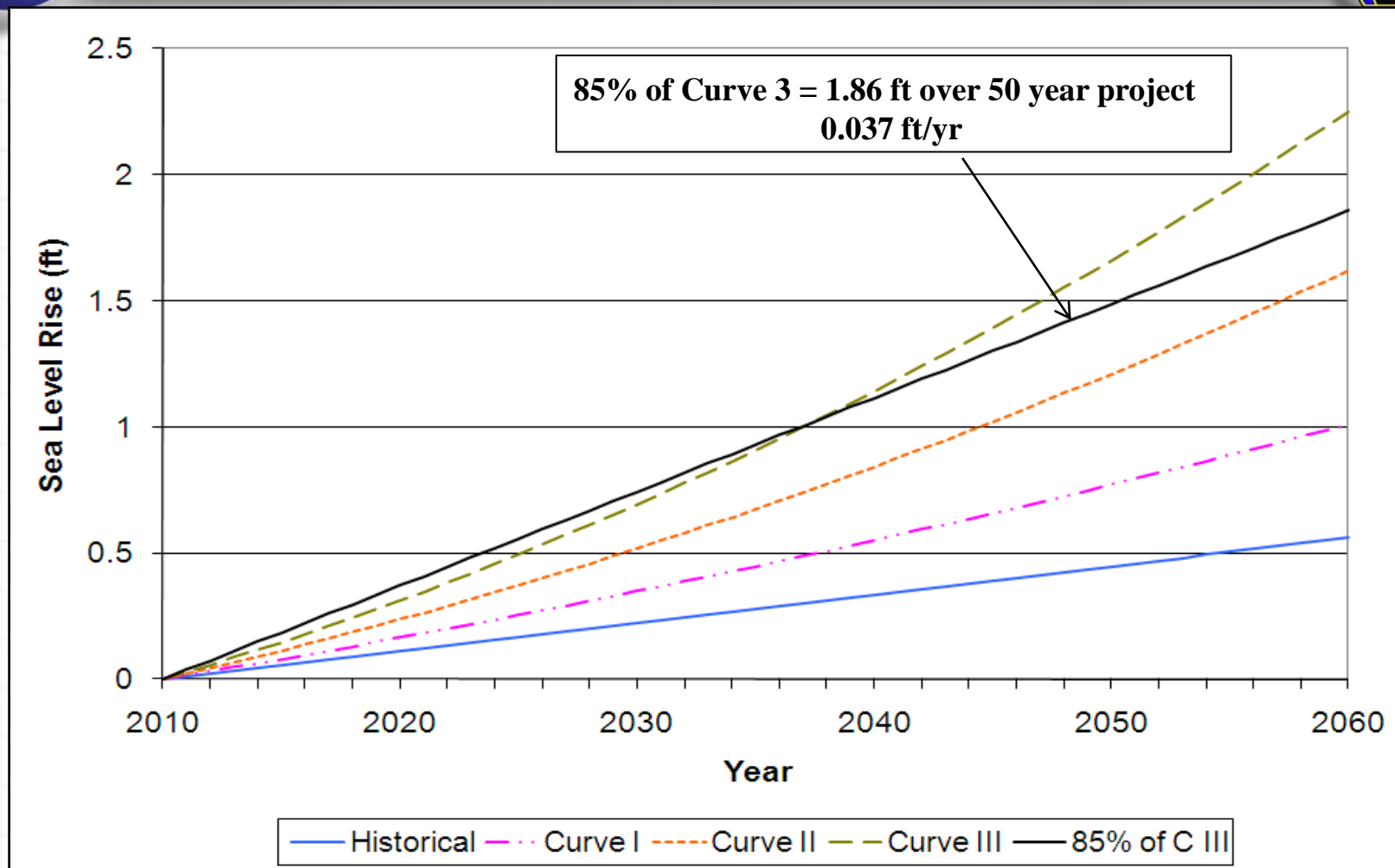
**WFF local sea level rise –
 $0.34 \text{ m} \pm 0.05 \text{ m/100 yr.}$**

*Small changes in sea level
can be expected to have
dramatic effects on
shoreline.*

NOAA Tide Stations used to obtain total SLR rate at Wallops Island, VA.



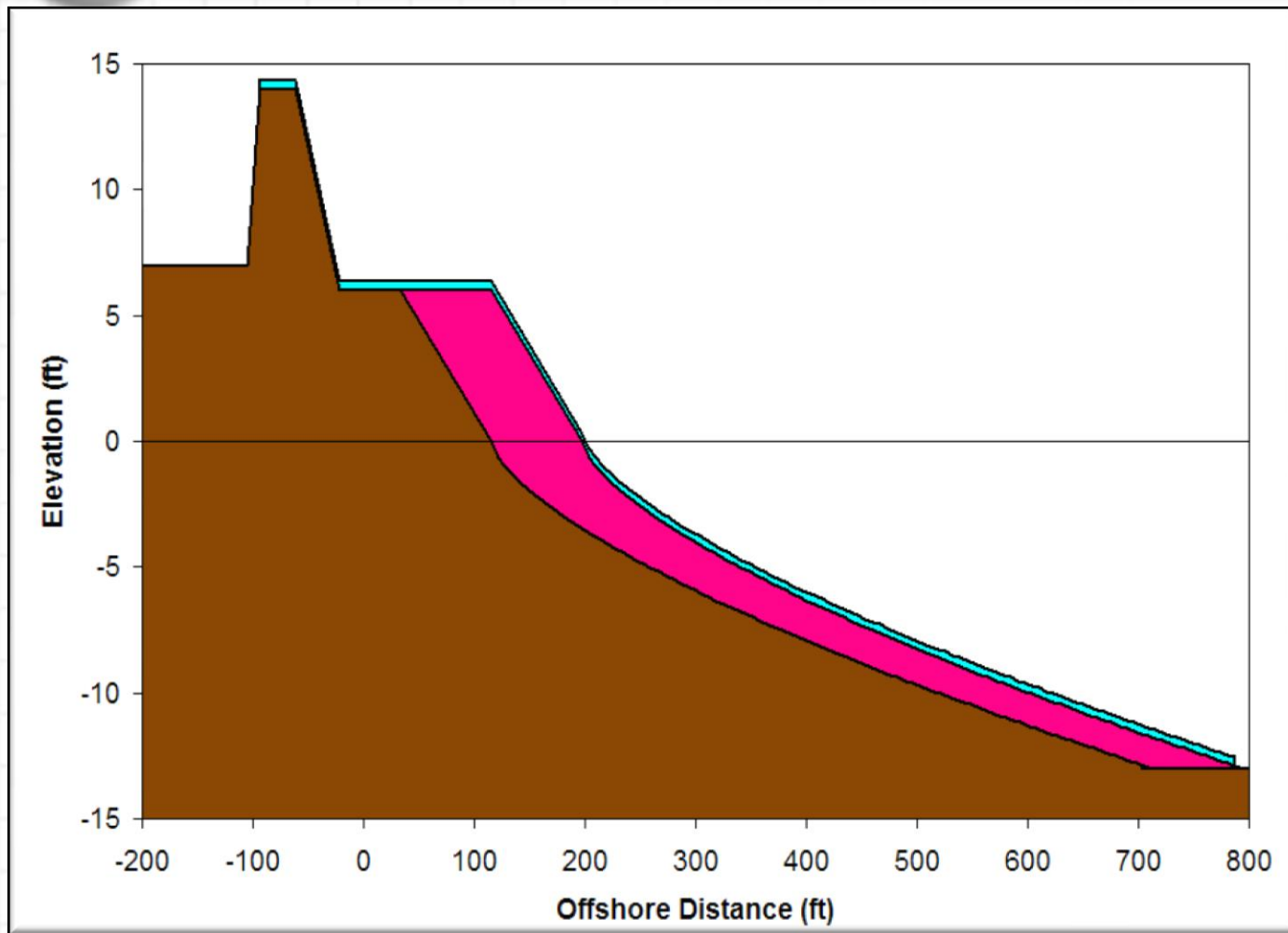
Projected Wallops Island, VA SLR




Projected Wallops Island, VA SLR, as based upon NRC (1987) curves.





Beach Re-nourishment



Projected beach fill profile per 5-year re-nourishment cycle.

 Minimum beach fill required to protect WFF assets

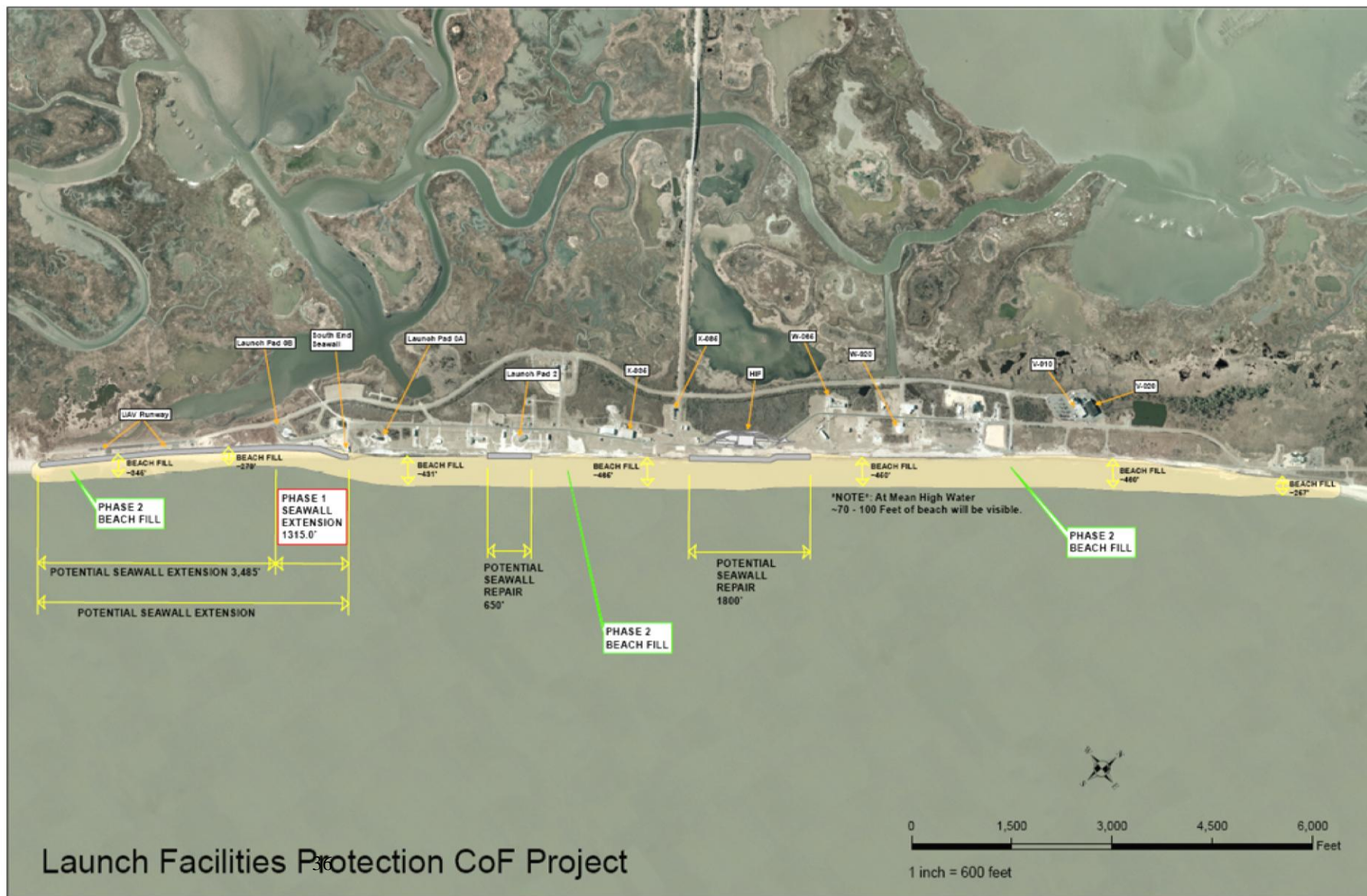
 Re-nourishment profile assuming a static sea level 806,00 yds³ (616,000 m³)

 Additional amount of material to compensate for sea level rise 112,000 yds³ (86,000 m³) or 14%

Based on monitoring data, the volume of material placed at each re-nourishment cycle can be adjusted to match the amount of sea level rise.



SRIPP



Launch Facilities Protection CoF Project



Questions?



Thank you for your interest!

